SAM Replica Catalog

EDG
May 12-16, 2003

Lee Lueking
Fermilab Computing Division
CEPA Department

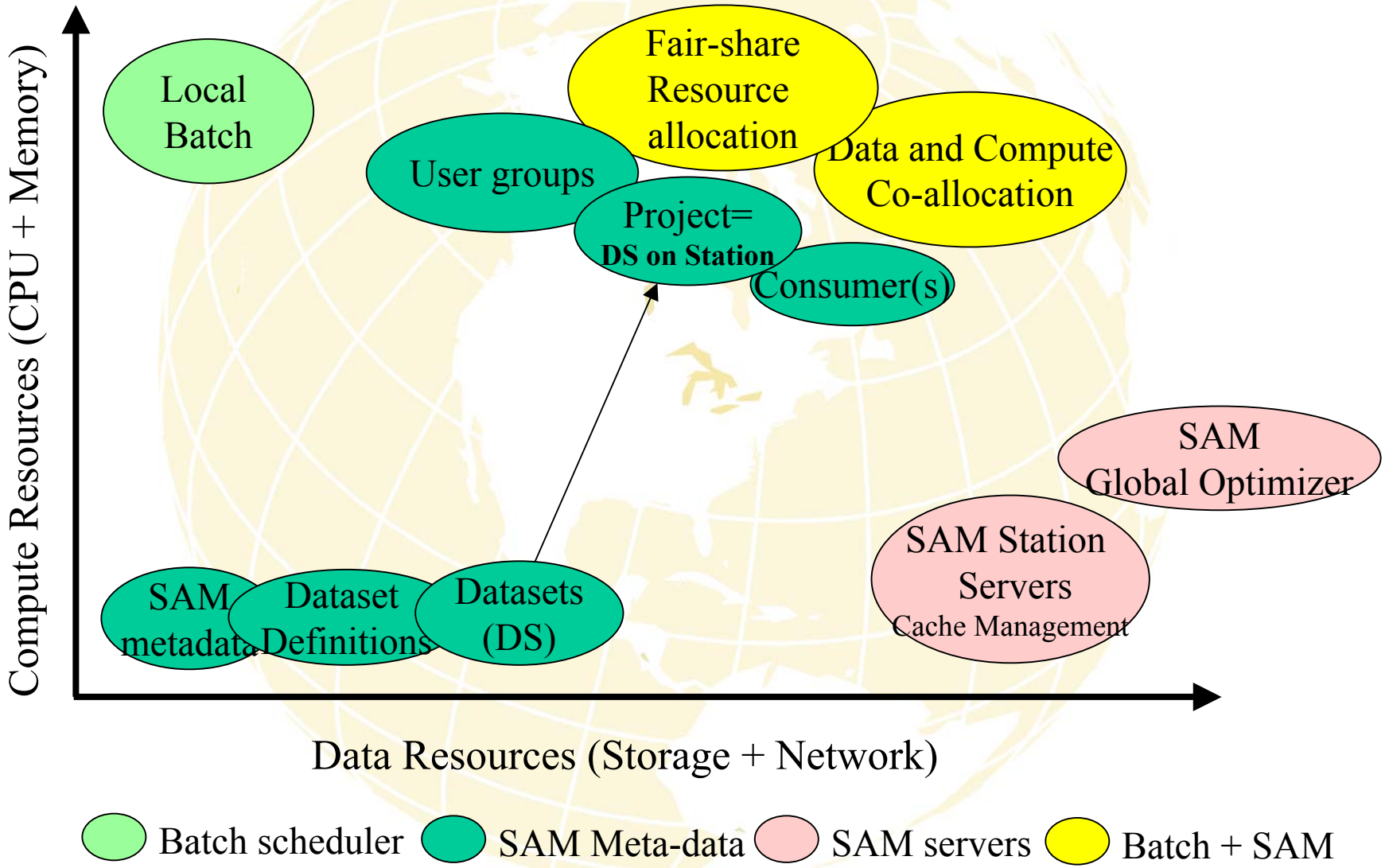
Roadmap of Talk

- SAM Data Management Overview
- EDG - SAM Cross Reference
- SAM Features and Use Case Examples
- EDG – SAM Command Reference
- Summary

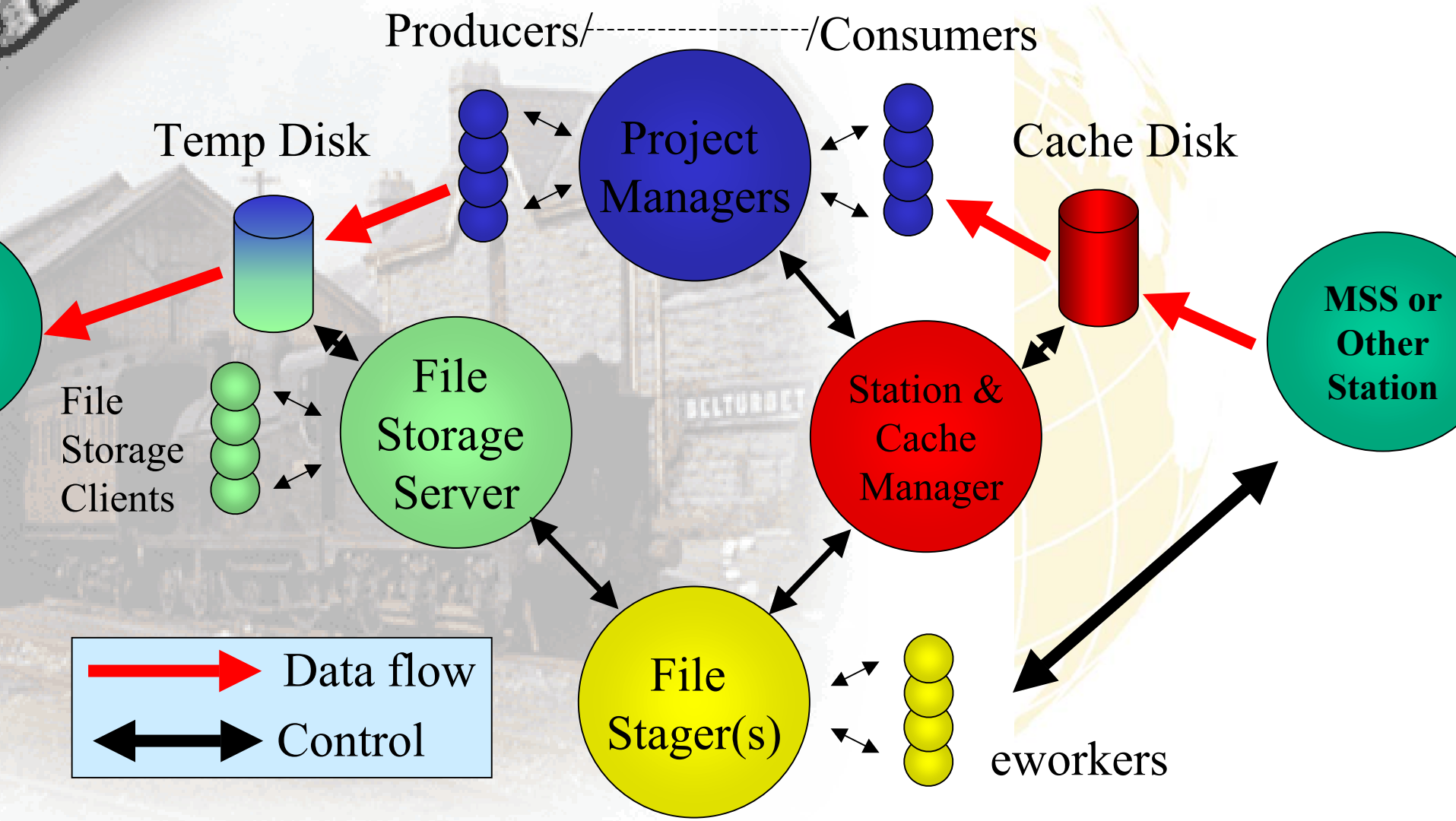
An Overview of SAM Data Management

d0db.fnal.gov/sam

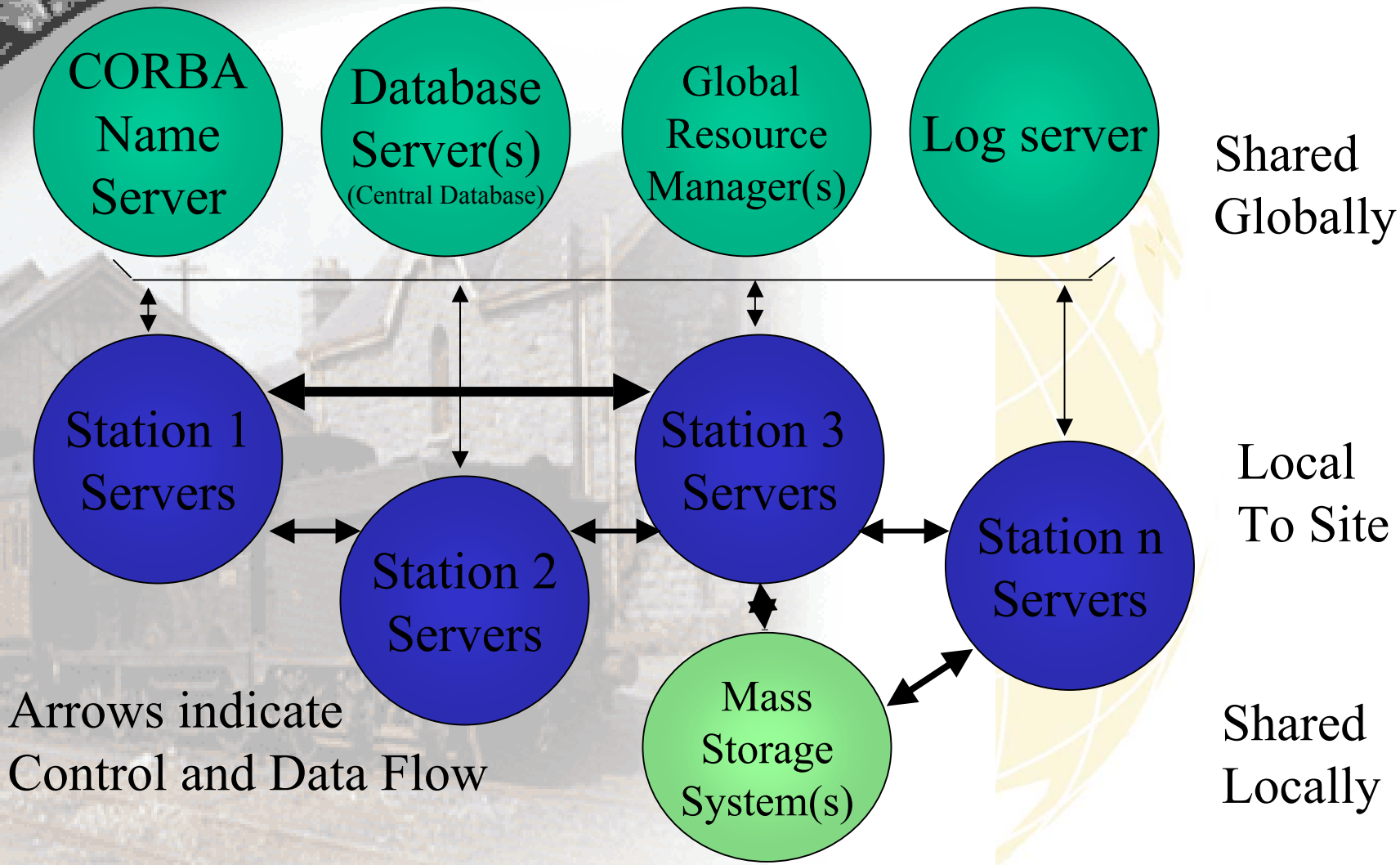
Managing Resources in SAM



SAM Station Components



SAM as a Distributed System



EDG and SAM Terminology

Preliminary – to generate discussion

Naming Conventions

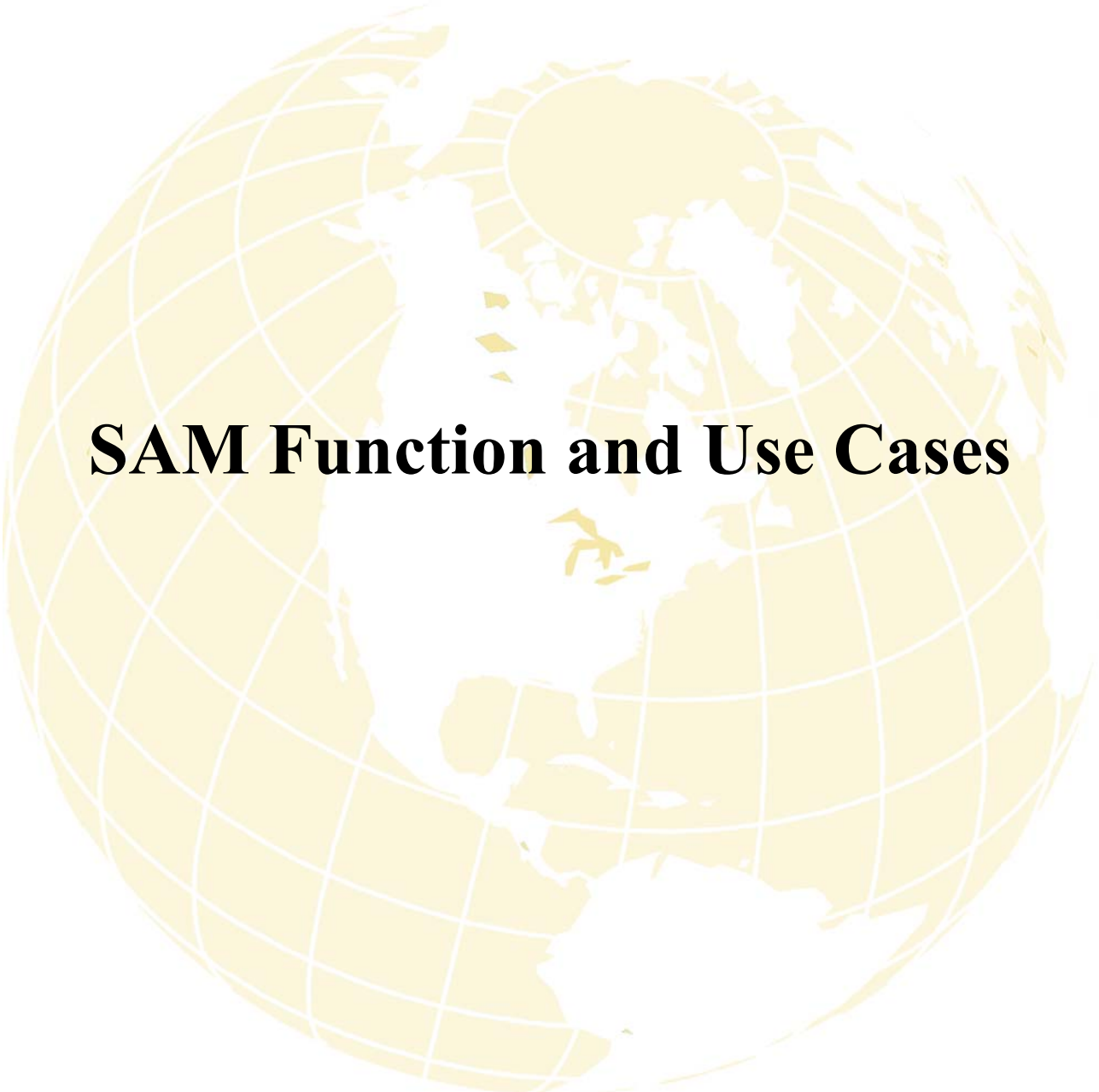
EDG Acronym	EDG Name	SAM Name or comment
SFN	Storage File Name	File Name.
UUID	Universally Unique IDentifier	Date and time info
GUID	Grid Unique IDentifier	File names must be unique
LFN	Logical File Name	Closest concept is dataset, or a collection of files referred to by logical name.
TURL	Transport URL	Location is stored as 1. host, station, or MSS with full unix path, or 2. url for network attached files (RFIO, dCAP)

Data Management

EDG Acronym	EDG Name	SAM Name or Comment
DMS	Data Management Services	SAM provides data management and adapters to storage systems.
RMS	Replica Management Services	Provided through SAM Stations in conjunction with SAM DB and Global Optimizer
RFT	Reliable File Transfer	SAM Stager. Uses retries and CRC to assure reliable transfer
SRM	Storage Resource Manager	SAM Station Cache management. Part of SAM station servers. Discussing migrating to the protocol referred to as "SRM" from LBNL.

Replica Management

EDG Acronym	EDG Name	SAM Name or Comment
ERM	EDG Replica Manager	SAM CORBA IDL's, SAM user interface, CLI and WEB
RLS	Replica Location Service	Through SAM DB server
LRC	Local Replica Catalog	File Locations table in Central SAM Database
RLI	Replica Location Index	Central Database
RMC	Replica Metadata Catalog	Data_files and other tables in SAM Database
ROS	Replica Optimization Service	SAM Optimizer
RSH	Replica Storage Handler	SAM Station



SAM Function and Use Cases

Storing and Accessing SAM Data and Meta-Data

- ✓ **Sam store**
  - **Description of metadata,**
  - **Auto destination**
  - **Station data forwarding**
- ✓ **The SAM Schema**
  - **tracking file lineage**
  - **The concept of "dimensions"**
- ✓ **SAM data Access**
  - **Using file metadata to create logical sets of files**
  - **Accessing files through projects on SAM stations**
- ✓ **SAM Station file replication and cache management**
  - **Station configurations with and without SAM stagers on workers**

Storing Data

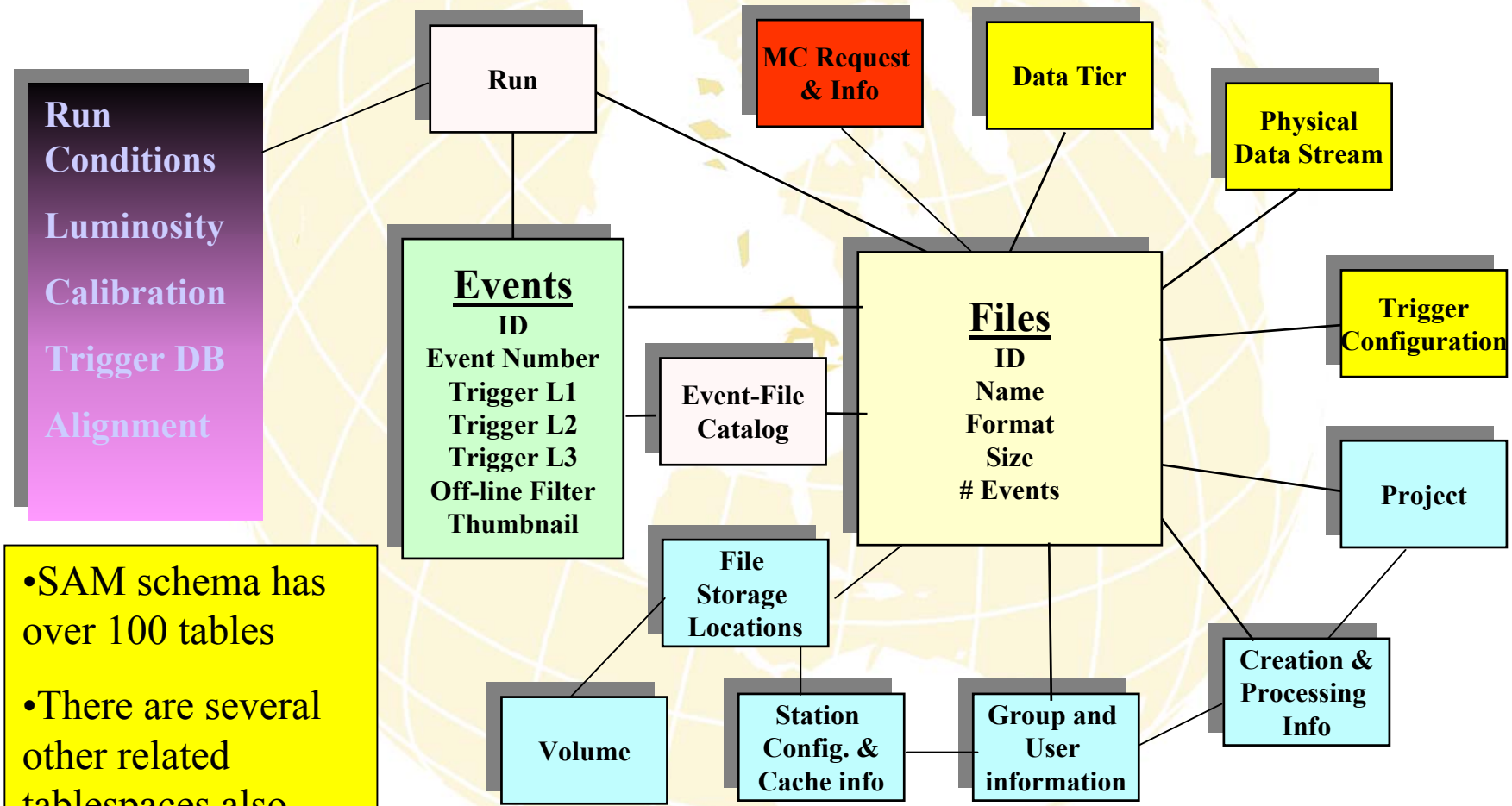
sam store –desc=DescriptionFile.py

- ✓ **Description files**
  - **Contain physics and file metadata.**
  - **Written as Python scripts**
  - **They are required to store data.**
  - **Latest version of description file uses name–value pairs for more flexibility in adding parameters for data and MC files**
- ✓ **Auto-destination**
  - **A map which relates information in the description file to physical storage location**
- ✓ **File forwarding**
  - **Data is forwarded from source station to designated physical storage location**

Example Description File

```
from import_classes import *
#
# Generated by runMCwin
#
my_d0gstar   = AppFamily( "simulator","p07.00.05a","d0gstar" )
class MyProcess(ProcFamily):
    group="higgs"
    origin_location="FNAL"
    origin_facility="d0mino"
    produced_for="Qizhong Li"
    phase="group-phase1"
    def __init__(self, stream, param_file, produced_by):
        self.stream=stream
        self.param_file=param_file
        self.produced_by=produced_by
class Simulator(MyProcess):
    appfamily=my_d0gstar
channel = Channel("bbh","bbbb")
minbi = MinBias("none","0.0")
d0g_fil=Simulator(stream="notstreamed",
                  param_file="d0gstar_test185201919.params",
                  produced_by="Avto Kharchilava")
d0g_file_import =SimulatedFile("d0g.pythia_bbh_bbbb1.dat",
    d0g_fil, 65123, Events(1, 500, 500),
   "07/03/2001 17:44", "07/04/2001 05:23",
    "pythia_bbh_bbbb1.dat", 1, 1, channel)
```

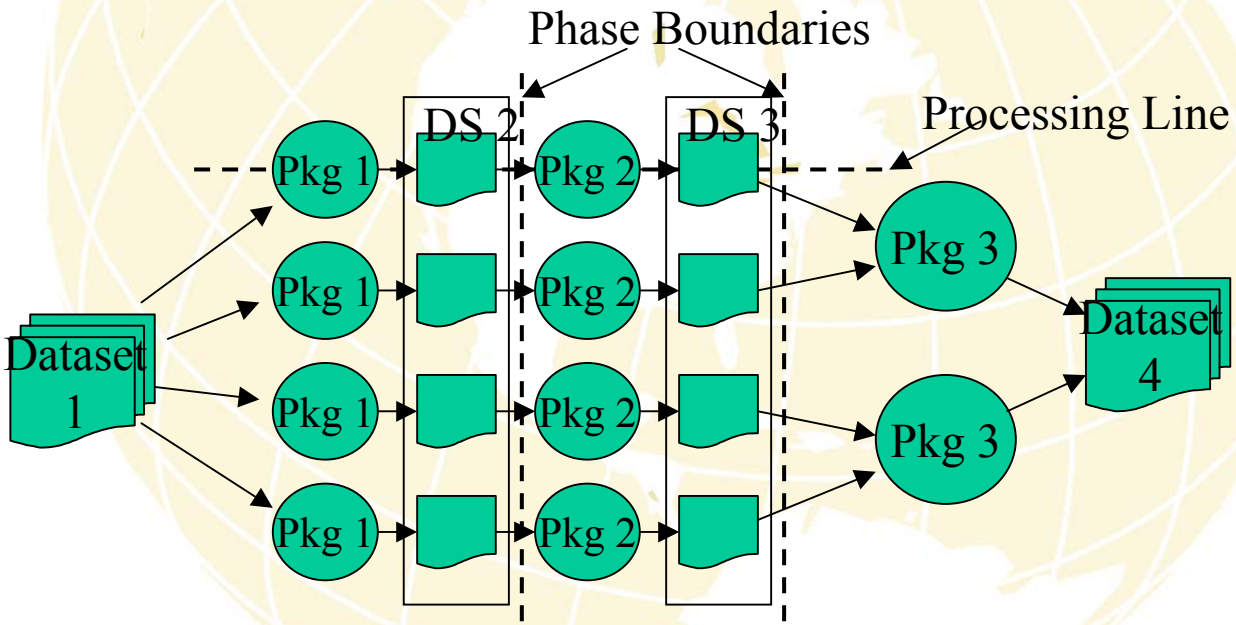
SAM Simplified Database Schema

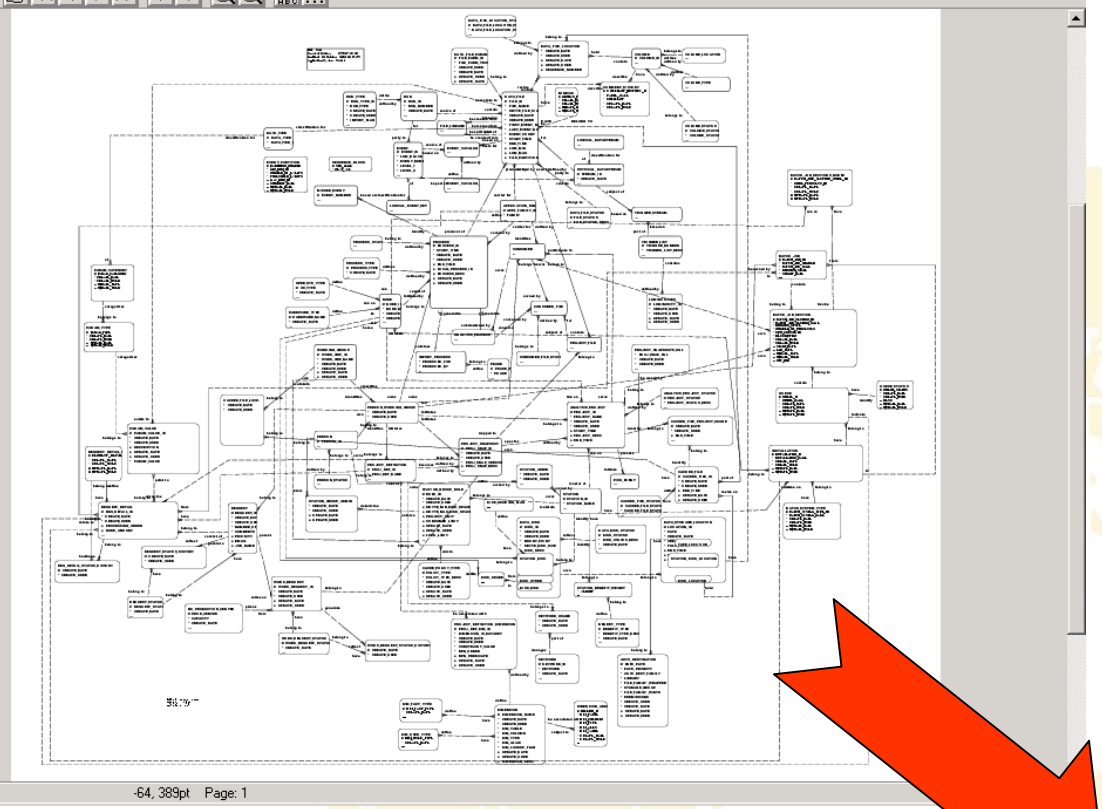


- SAM schema has over 100 tables
- There are several other related tablespaces also available

Tracking File Lineage

- ✓ Application name and version information (Pkg)
- ✓ Parent or parents information
- ✓ File splitting and merging.





Challenge: Transform the complex SAM schema into a form that is user friendly, and avoids badly formed user SQL queries.

Solution: Transform the schema to look like one giant table.

DataFile

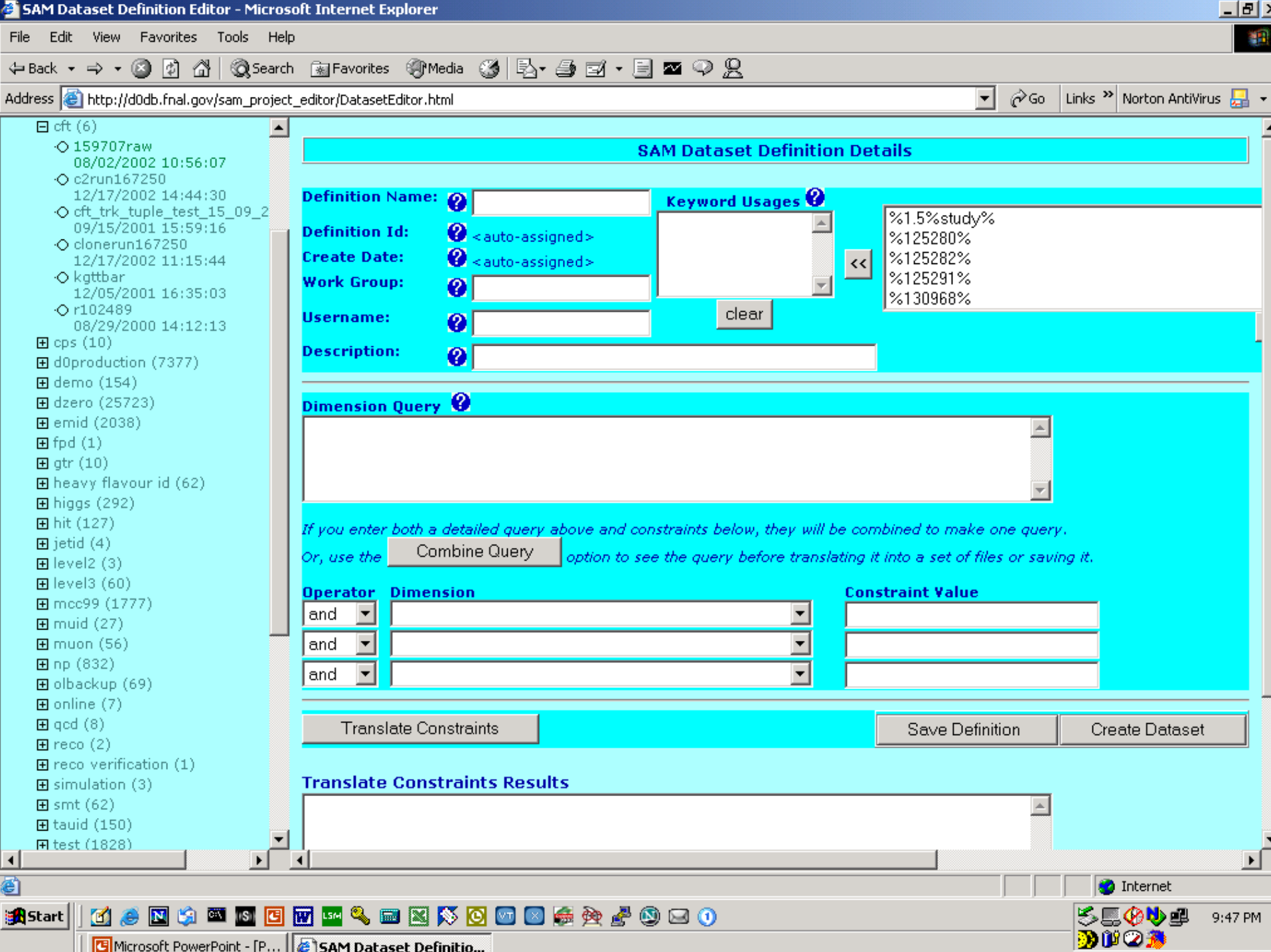
Dimension Name

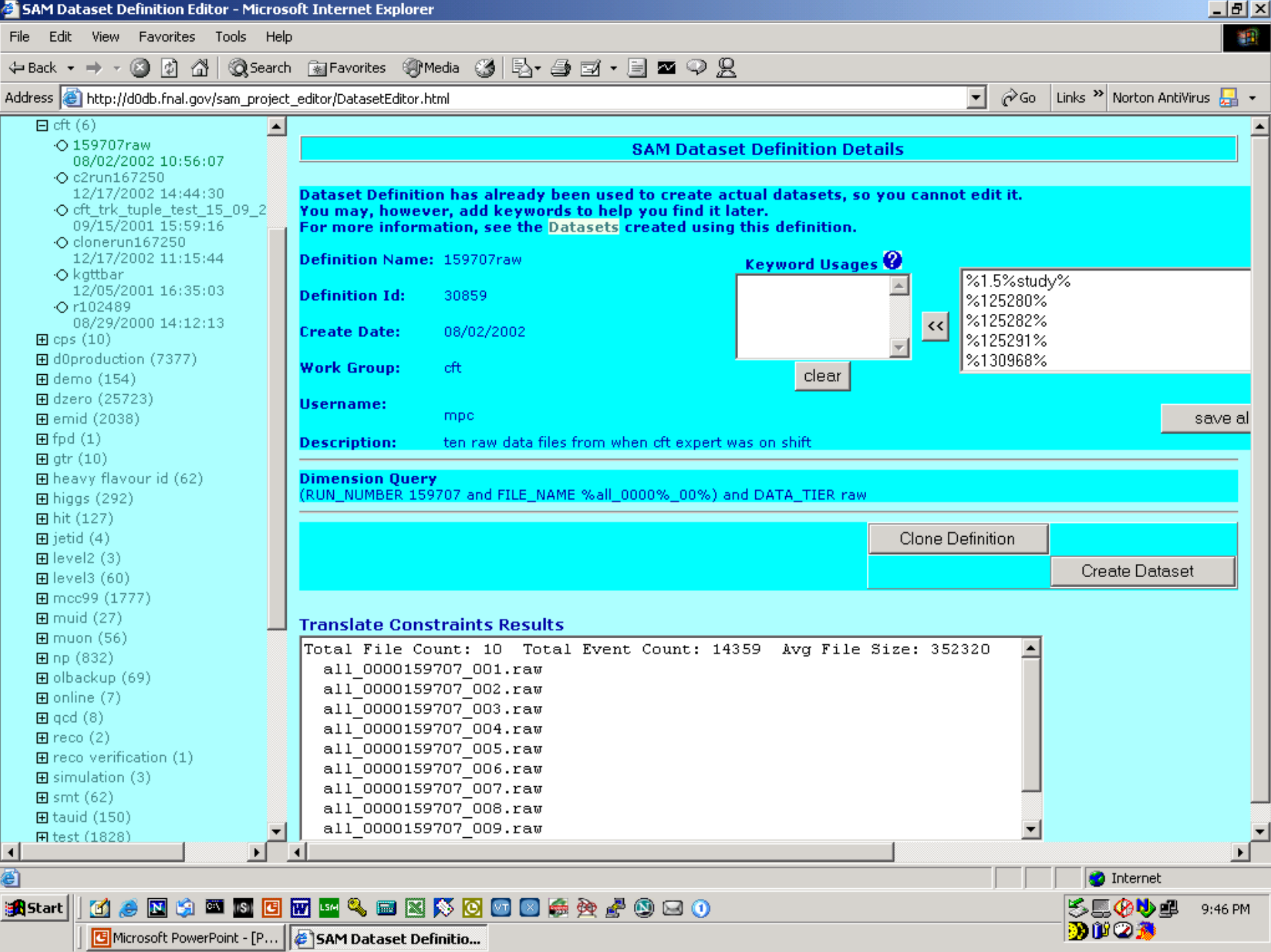
file	Run	Event	Date	Trigger	Apo	App vsn	…
file1							
file2							
file3							
file4							
file5							
filen							

●●●

Accessing Data: Defining Datasets

- ✓ There are dozens of dimensions available and they are easily defined.
  - APPL_NAME, APPL_NAME_ANALYZED, CONSUMED_DATE, CONSUMED_STATUS, CONSUMER, CONSUMER_GROUP, CONSUMER_ID, CREATE_DATE, DATASET_DEF_ID, DATASET_DEF_NAME, DATASET_ID, DATASET_VERSION, DATA_FILE_LOCATION_STATUS, DATA_TIER, DATA_TIER_ANALYZED, DELIVERED_STATUS, EVENT_NUMBER, FAMILY, FAMILY_ANALYZED, FILE_ANALYZED, FILE_NAME, FILE_PARTITION, FILE_STATUS, FULL_PATH, LOGICAL_DATASTREAM_NAME, PARAM_TYPE, RUN_ID, RUN_NUMBER, RUN_QUALITY, VERSION, VERSION_ANALYZED, WORK_GRP_NAME , etc., etc., etc.
- ✓ __SET__ : Special dimension allowing you to include an existing dataset definition.
- ✓ Constraint operators:=, !=, >, < >=, <=, like, not like, in, not in, between, is null, is not null
- ✓ Sets operators: and, or, minus, (union, intersection to be added)
- ✓ syntax: --dim="[(]name [conOper] value [setOper name [conOper] value][)] ..."
- ✓ Command line examples:
  - **sam define dataset** --defname=dataset_definition_name --group=work_group_name --dim="(run_number 100930 data_tier digitized) minus physical_datastream_name electron+jet"
  - **sam create dataset** --defname=dataset_definition_name


SAM Dataset Definition Editor - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://d0db.fnal.gov/sam_project_editor/DatasetEditor.html
Go Links Norton AntiVirus
cft (6)
159707raw
08/02/2002 10:56:07
c2run167250
12/17/2002 14:44:30
cft_trk_tuple_test_15_09_2
09/15/2001 15:59:16
clonerun167250
12/17/2002 11:15:44
kgttbar
12/05/2001 16:35:03
r102489
08/29/2000 14:12:13
cps (10)
d0production (7377)
demo (154)
dzero (25723)
emid (2038)
fpd (1)
gtr (10)
heavy flavour id (62)
higgs (292)
hit (127)
jetid (4)
level2 (3)
level3 (60)
mcc99 (1777)
muid (27)
muon (56)
np (832)
olbackup (69)
online (7)
qcd (8)
reco (2)
reco verification (1)
simulation (3)
smt (62)
tauid (150)
test (1828)
SAM Dataset Definition Details
Definition Name:
Definition Id: <auto-assigned>
Create Date: <auto-assigned>
Work Group:
Username:
Description:
Keyword Usages
clear
<<
%1.5%study%
%125280%
%125282%
%125291%
%130968%
Dimension Query
If you enter both a detailed query above and constraints below, they will be combined to make one query.
Or, use the Combine Query option to see the query before translating it into a set of files or saving it.
Operator
Dimension
Constraint Value
and
and
and
Translate Constraints
Save Definition
Create Dataset
Translate Constraints Results
Internet
Start
Microsoft PowerPoint - [P...
SAM Dataset Definitio...
9:47 PM


SAM Dataset Definition Editor - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://d0db.fnal.gov/sam_project_editor/DatasetEditor.html
Go Links Norton AntiVirus
cft (6)
159707raw
08/02/2002 10:56:07
c2run167250
12/17/2002 14:44:30
cft_trk_tuple_test_15_09_2
09/15/2001 15:59:16
clonerun167250
12/17/2002 11:15:44
kgttbar
12/05/2001 16:35:03
r102489
08/29/2000 14:12:13
cps (10)
d0production (7377)
demo (154)
dzero (25723)
emid (2038)
fpd (1)
gtr (10)
heavy flavour id (62)
higgs (292)
hit (127)
jetid (4)
level2 (3)
level3 (60)
mcc99 (1777)
muid (27)
muon (56)
np (832)
olbackup (69)
online (7)
qcd (8)
reco (2)
reco verification (1)
simulation (3)
smt (62)
tauid (150)
test (1828)
SAM Dataset Definition Details
Dataset Definition has already been used to create actual datasets, so you cannot edit it.
You may, however, add keywords to help you find it later.
For more information, see the Datasets created using this definition.
Definition Name: 159707raw
Definition Id: 30859
Create Date: 08/02/2002
Work Group: cft
Username: mpc
Description: ten raw data files from when cft expert was on shift
Keyword Usages
<<
clear
%1.5%study%
%125280%
%125282%
%125291%
%130968%
save al
Dimension Query
(RUN_NUMBER 159707 and FILE_NAME %all_0000%_00%) and DATA_TIER raw
Clone Definition
Create Dataset
Translate Constraints Results
Total File Count: 10 Total Event Count: 14359 Avg File Size: 352320
all_0000159707_001.raw
all_0000159707_002.raw
all_0000159707_003.raw
all_0000159707_004.raw
all_0000159707_005.raw
all_0000159707_006.raw
all_0000159707_007.raw
all_0000159707_008.raw
all_0000159707_009.raw
Internet
Start
Microsoft PowerPoint - [P...
SAM Dataset Definitio...
9:46 PM

SAM User API

- ✓ Lightweight python interface to the sam command suite allowing multiple sam tasks to be performed and the results manipulated according to the users desire.
- ✓ For example:

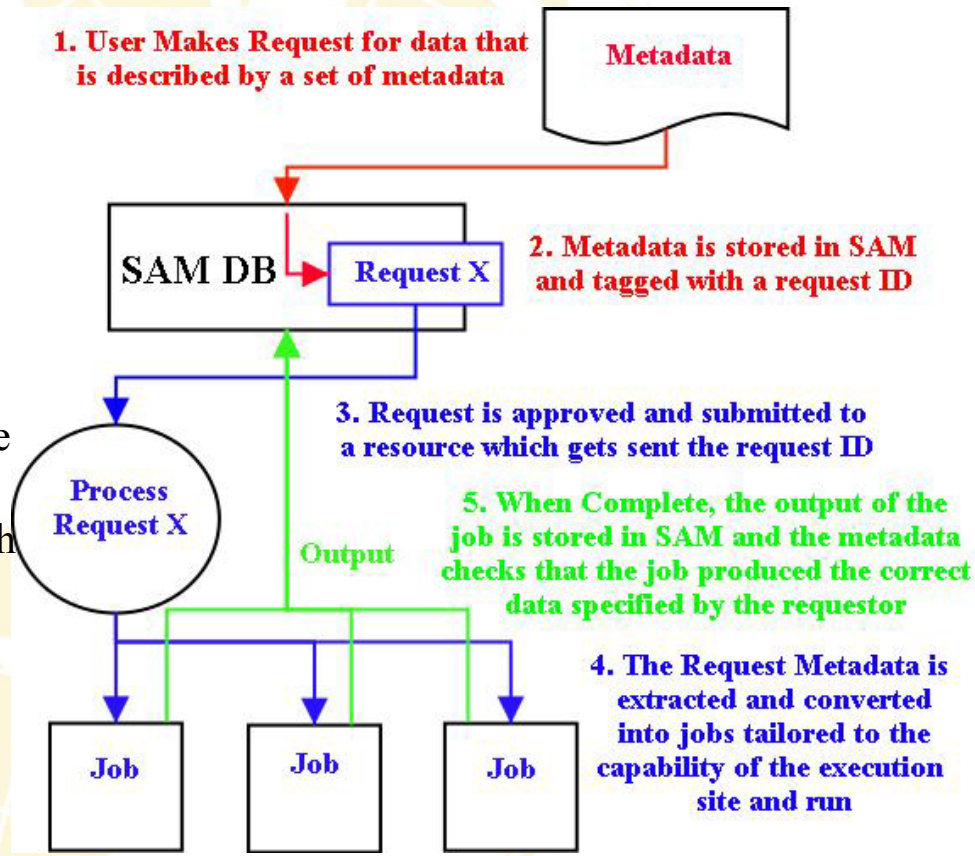
  import SamUserApi

  sam = SamUserApi.SamUserApi()

  provides an object which has all the needed sam functionality.
- ✓ So starting up sam file delivery tasks and querying the delivery status of each file and building lists of files which had problems and need to be retried.
- ✓ Allows simple, dynamic control and tailoring of file delivery on the fly based on what is happening with a job.
- ✓ For example, submitting processing jobs as files become available to optimise resource usage. Eg, if only a few files are available at a time then only a few jobs are started, but if more files arrive, then more jobs can be started.

Monte Carlo Request System

- ✓ User defines required data in terms of a set of metadata keyword/values which define the physics details of the requested MC sample.
- ✓ This is then stored in SAM and when the request is processed, this physics data is extracted, and augmented with further 'processing mechanics' information and converted into executable jobs which are tailored to the resource they are executed on.
- ✓ The resulting data is stored in SAM with the physics metadata augmented by the details of the workflow and data provenance.
- ✓ Essentially it provides a **metadata materialization service** **(a.k.a. virtual data system).**



EDG and SAM Commands

Preliminary – to generate discussion

Storage Management Commands

EDG Command	Action	SAM equivalent and Comment
copyAndRegisterFile (cp)	Store and register	Sam store
replicateFile (rep)	Replicate a file	Station cache operation
deleteFile (dEl)	Remove file and unregister	Rm file and "sam undeclare", Not allowed for files with existing links

Catalog Commands

EDG Command	Action	SAM equivalent and comment
registerFile (rf)	Register file in catalog	Sam declare
registerGUID (rg)	Register file with known GUID in catalog	Sam add location
unregisterFile (uf)	Unregister file from catalog	Sam undeclare, Not allowed for files with existing links
listReplicas (lr)	List replicas	Sam get file location
listGUID (lg)	List GUID of LFN or SFN	Sam translate constraints (possibly)
addAlias	Add an LFN alias to existing GUID	Sam create dataset

Catalog and File Transfer Commands

EDG Command	Action	SAM equivalent
getBestFile (gbf)	Replicate a file from best source	Done by station in global routing
listBestFile (lbf)	List replica with smallest access cost	Internal to station
getAccessCost (ac)	List access costs for all replicas	Internal to station
copyFile (cp)	Copy a file to local destination	Done via project definition and project manager

Additional SAM Commands (of possible interest)

- ✓ Some are tied to storage management, and not strictly the file metadata or file replica catalog.
- ✓ Many other administrative commands for controlling station, **auto-destination map**, and monitoring.

SAM Object	Possible Actions via Commands
File	Declare, store, dump, erase, get metadata, insert crc, mark content status
File physical locations	Add, erase, mark status
Dataset definitions	create
Dataset	Create (made from DS definition)
Projects	Get next file, create project, create consumer
Mc request	Create, get details, modify details, modify status,

Summary

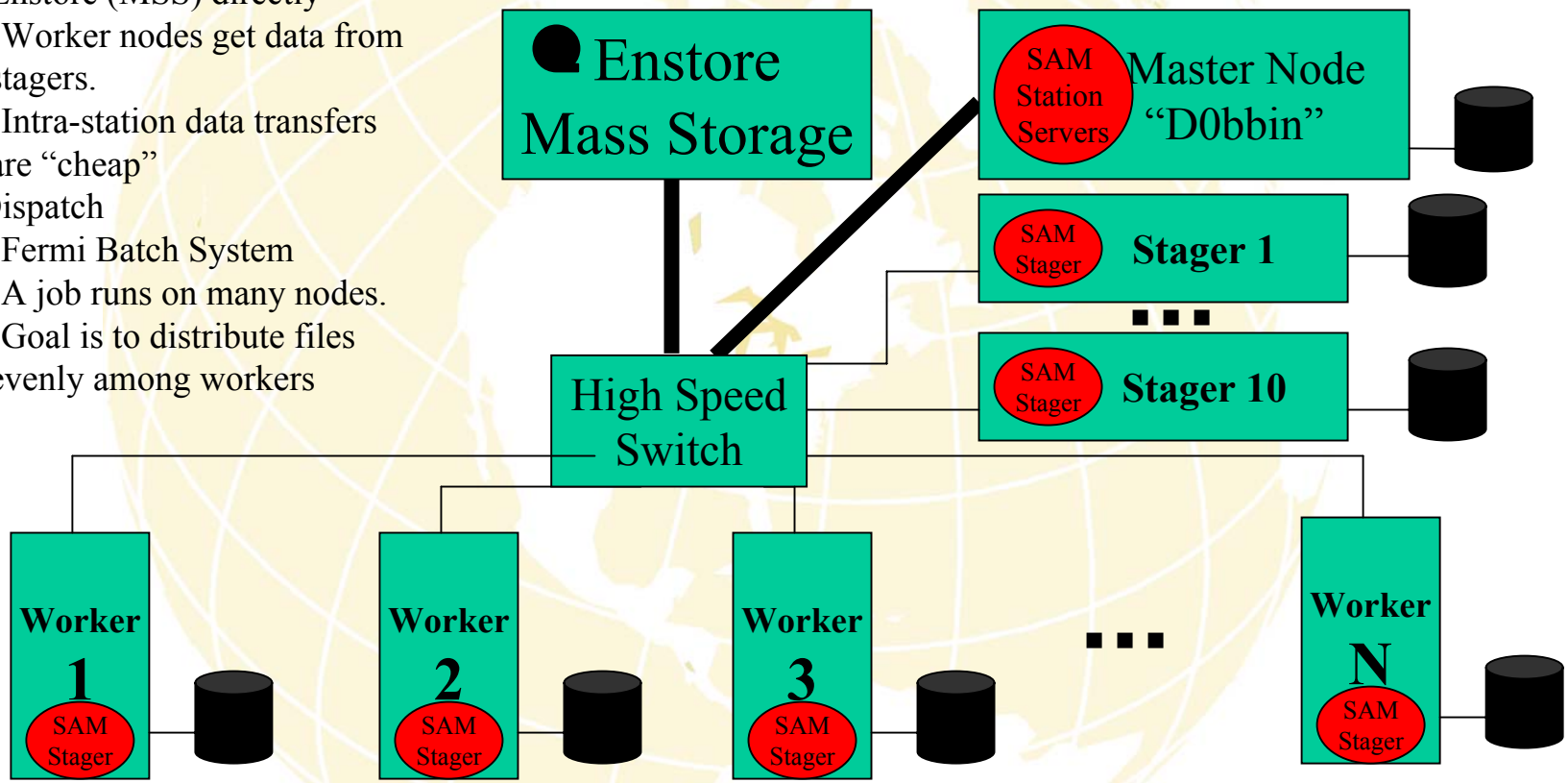
- ✓ **SAM is distributed, end-to-end Data Management and Handling tool providing the ability to store, and access data and associated metadata information.**
- ✓ **The SAM Database Schema provides many capabilities to maintain physics and processing related information about the data.**
- ✓ **There are many commonalities between the EDG and SAM concepts and the commands for management and access can be readily mapped.**
- ✓ **At this meeting I hope we can plant the seeds needed to achieve the common interfaces which will allow the EDG wp2 and SAM to provide replica services for both EDG and SAM-Grid.**

Thank You

SAM Station: Dzero Distributed Cache Reconstruction Farm

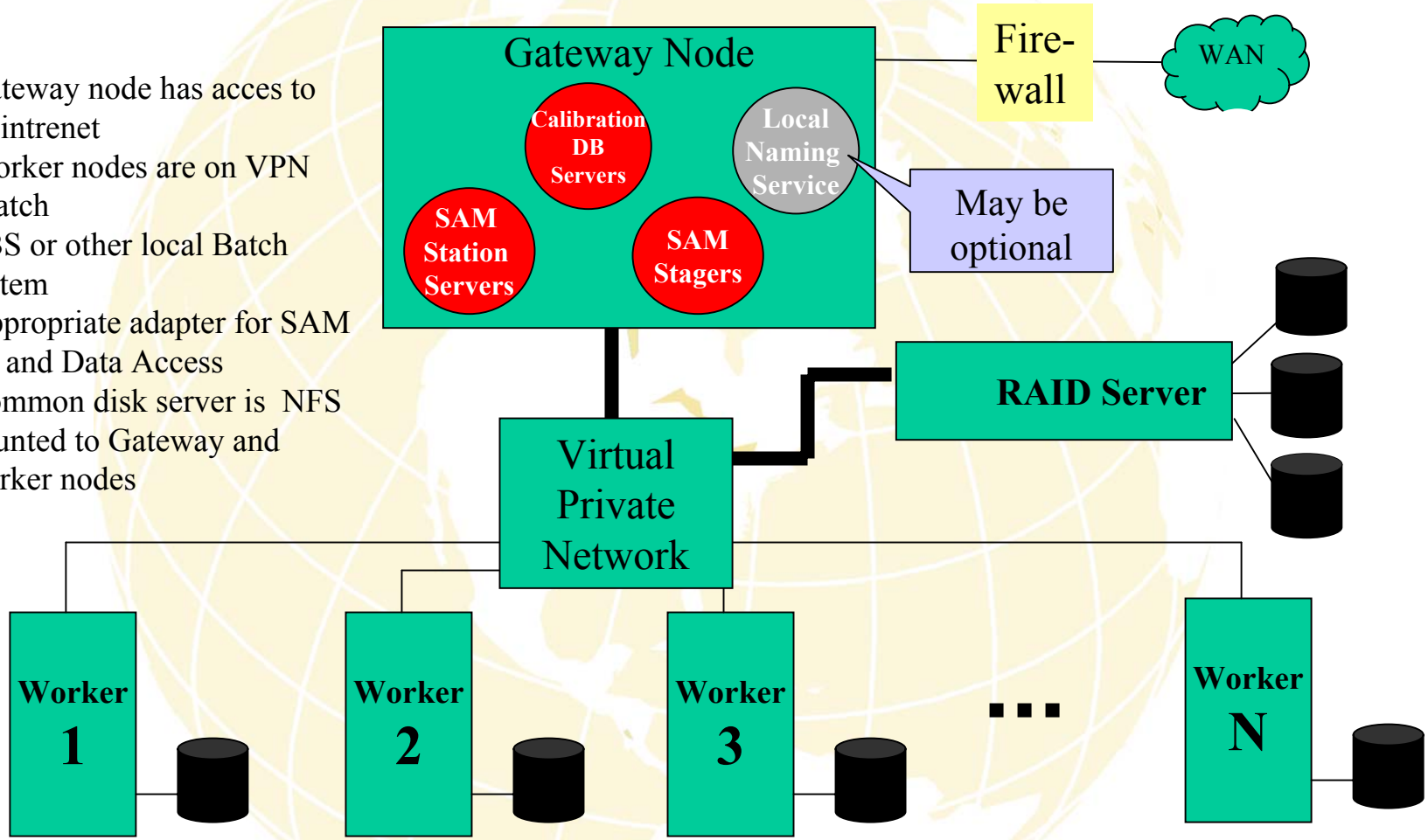
- Network
  - Each Stager Node accesses Enstore (MSS) directly
  - Worker nodes get data from stagers.
  - Intra-station data transfers are "cheap"
- Job Dispatch
  - Fermi Batch System
  - A job runs on many nodes.
  - Goal is to distribute files evenly among workers

SAM manages replicas within a cluster too



SAM Station: Shared Cache Configuration w/ PN
(used at GridKa and U. Michigan NPACI)

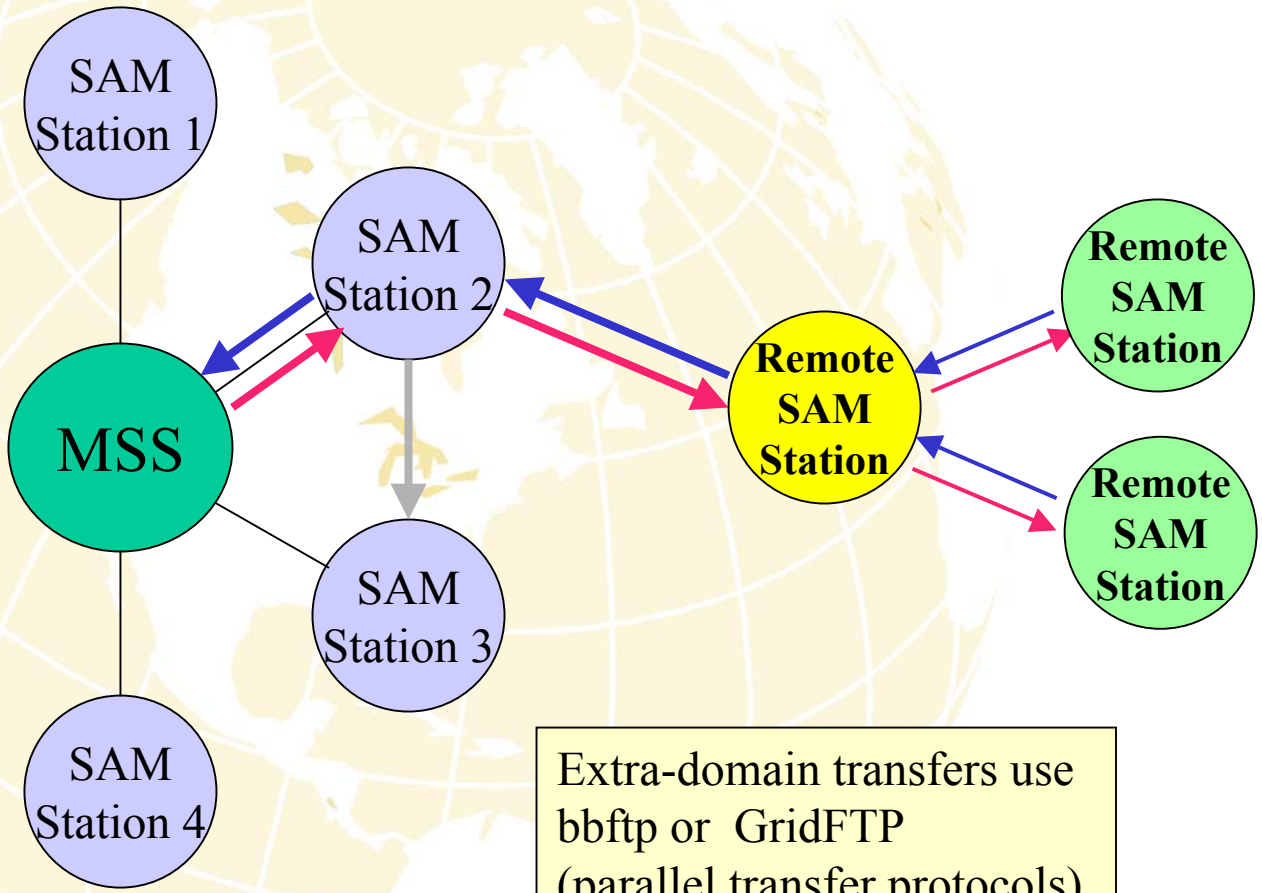
- Network
  - Gateway node has acces to the intrenet
  - Worker nodes are on VPN
- Job Dispatch
  - PBS or other local Batch System
  - Appropriate adapter for SAM
- Software and Data Access
  - Common disk server is NFS mounted to Gateway and Worker nodes



Data to and from Remote Sites

Data Forwarding and Routing

Station Configuration
- **Replica location**
  - **Prefer**
  - **Avoid**
- **Forwarding**
  - **File stores can be forwarded through other stations**
- **Routing**
  - **Routes for file transfers are configurable**



Extra-domain transfers use bbftp or GridFTP (parallel transfer protocols)